Fire usually affects fish habitat only by removing vegetative cover In some cases, this may also increase erosion, thus decreasing water quality and adversely affecting fish habitat. Managed fire will generally not have much effect on riparian vegetation or water quality. Thus, the effects of prescribed fire on fish habitat will generally be insignificant.

Roads may have a number of direct and indirect effects on fish. (For a discussion about the effect of roads on fish, see Forest Service General Technical Report PNW-109 "*Planning Forest Roads to Protect Salmon Habitat*") Direct effects include: (1) blockage of upstream migration for resident and anadromous fish due to inadequate culverts and change in streamflow characteristics, and (2) reduction in quantity and quality of available fish habitat due to road location

Indirect effects are mostly due to water quality changes including (1) reduction in vegetative stream cover, (2) increases in sediment (as affected by road design, location and maintenance), and (3) utilization of chemicals on roads Road access disperses anglers and allows utilization of a greater amount of the resource

In wilderness and other unroaded areas, the effects of historical management activities may not be very obvious, but even here the evidence of many years of livestock grazing are apparent in some places In the roaded portions of the Forest, the effects of historical management activities are apparent in most streams and riparian areas The magnitude of these effects varies widely from stream to stream, but the following generalizations can be made Logging activities, including historical railroad logging and the road construction associated with modern timber harvest activities have occurred over most of the Forest Effects of livestock grazing are common Forest-wide, but are more pronounced in the southern part of the Forest than in the northern part Effects of mining activity are concentrated in the Middle Fork John Day River and its tributaries. Only a few streams on the Forest now have resident beaver on a long- term basis Beaver can also be found in some other streams temporarily, that is, for a few years at a time

5 Water

The rivers and streams of the Forest are a valuable resource in northeastern Oregon. These streams and rivers originate in, and flow through, productive and beautiful forests They provide high-quality water for spawning and rearing of anadromous fish, and habitat for resident trout and other native fish species Off-Forest water uses are also very valuable, domestic and industrial uses and irrigation of agricultural lands are the primary downstream uses

Intensive water quality monitoring started on the Forest in 1978 Water quality data has been collected from 41 water quality monitoring stations on 31 different streams Some of these stations have records for only 1 or 2 years while others have been monitored continuously, although at different intensity levels Most of the sampled streams were on the Long Creek Ranger District because it was within the proclaimed study area of the Oregon Range and Related Resources Evaluation Project (EVAL) Special project funding was received between 1978 and 1987 Publishing the results of this study, including the water quality reports, was the responsibility of the Forestry & Range Sciences Laboratory in La Grande, Oregon Water quality monitoring is continuing on the Forest on a limited basis. The water quality information now being collected is water temperature data for selected streams, and a reduced level of data collection for some of the original EVAL stations. Copies of the information are available for review at the Laboratory in LaGrande and at the Supervisor's Office in John Day

Climate, vegetation, and management activities will affect water resources on the Forest. A high desert climate with low precipitation and high summer temperatures results in low humidity and rapid evaporation The Forest's precipitation zones range from 20 inches at low elevations to 40 inches at high altitudes Climate records show great variability in when precipitation occurs and in what form

Generally, the months of June, July, and August are hot and dry, although some years had significant rainfall amounts during that period The snowfall period occurs from November through March Due to the relatively low elevation of the Forest, the snowpack can be gone from low elevations by March. This produces a variable snowmelt/runoff period because by the time high elevations begin to produce runoff, the low-elevation snowpack is gone The amount of high-elevation terrain which holds a snowpack into late spring is very limited on the Forest Only in areas like the Strawberry Mountain Wilderness do small, isolated patches of snow remain into the summer season

The quality of water leaving the Forest varies with the season, geology, land use, and elevation. Sediment concentrations tend to increase during snowmelt runoff, and non-forested lands typically produce higher sediment yields than forests. On upland areas, this is due to shallow soils with low capacities for holding water, and minimal ground cover. Both of those factors increase surface runoff during thunderstorms. Sediment is also generated from streambank erosion and gullies On forested lands, roads and streambanks are the primary sources of sediment.

Concentrations of fecal coliform bacteria, an indicator of animal excrement, vary widely. Although most of the water on the Forest is of acceptable bacterial quality, many streams with heavy livestock concentrations may have conditions offensive to humans.

Water yields vary throughout the year, with peak runoff resulting from snowmelt Annual runoff from the Forest averages just over 600,000 acre feet per year Water yield also varies substantially from year to year. High or low flows for a 10-year period (i e., streamflows which have a 10 percent chance of occurring in any given year) can vary as much as 180 percent from the average annual flow

Assuming streamflow runoff has an average fall of 1,000 feet before leaving the Forest, and if all the potential energy available in that water could be converted to electricity distributed evenly throughout the year, about 72 megawatts would be available. This contrasts with a figure of 194 megawatts for all selected sites on the entire John Day River System, each of which could produce 200 kilowatts or more at least 50 percent of the time (Klingeman 1979)

From a practical standpoint, development of even a few percent of the theoretical potential power generation would be unlikely The fall rate on most large streams is too low for practical power generation without artificially created falls (dams) The power-generating potential of smaller streams west of the Cascade mountain range is so much greater than here (and at a lower cost per kilowatt) that little interest has been shown in hydropower locally Commercial power-generating interests do exist at the falls on the South Fork of the John Day River and at Olive Lake, both of which are near, but outside, the Forest boundary

There is a need to maintain some level of instream flow, both on and off the Forest, to maintain fisheries and other resource values To date, this has been accomplished on a case-by-case basis within the Forest boundary Off-Forest instream flows are of significant interest when they affect fisheries on the Forest. Off-Forest streamflows are the responsibility of the State of Oregon

Water uses on-Forest include administrative use, fire suppression, road construction and dust abatement, recreational facilities, livestock, and instream flow. On lands originally proclaimed as part of the National Forest System, water is "reserved" for timber production and watershed protection Also reserved are water supplies for nurseries supporting timber production or watershed protection plantings

Table III-13 summarizes beneficial uses by subbasin. It reveals that throughout the basin there are certain common denominators for water use. For example, domestic, irrigation, livestock, municipal, and storage uses occur in each of the subbasins. Quantities for uses other than irrigation, mining, and power are generally very limited. The table shows that the use of water for irrigation accounts for over 80 percent (by volume) of all water appropriated in the basin Mining is the next most dominant use, with 12 percent by volume.

TABLE III-13: Existing Water Rights by Beneficial Use and Subbasin of the John Day River Basin (Cubic Feet Per Second)

Water Use	Lower Main Stem	Middle Main Stem	Upper Main Stem	North Fork	Middle Fork	South Fork	Total
Agriculture			*				*
Commercial				3 7			3.7
Lawn & Garden	0 3	*	0 2	0 1		*	0.6
Domestic	1 2	0 2	1 6	1 2	1.8	0.1	6.1
Fishlife	0 6	0 2	12 8	2 0			15.6
Fire Protection		*	0 2			0.1	0.3
Industrial	0 8	7 3		2 1		2.2	12.4
Irrigation1/	446 3	278 2	927 0	291 5	88.5	97.5	1,067.0
Livestock	2 1	0 5	0 9	1 7	0 8	0 3	6 3
Mining		30 8	40 5	202 2	49 5		323 0
Municipal	16 4	4 4	9 3	3 9	3 1	5 1	42.2
Power			13 9	25 0	0 8		39.7
Quasi-Municipal	5 3						5.3
Recreation	0 2		*	2 0	*		2 2
Storage2/	(1,976)	(3,446)	(681)	(1,898)	(82)	(377)	(8,460)
Temp Control	3 3						3.3
Wildlife	*	*				*	
Other3/		6 5	4 3	7			11.5
Total4/	476 5	328 1	1,010 7	536 1	144 5	105 3	1,522 7

* Less than 0 1 cubic feet per second

1/ Irrigation allowed 6 months per year Figure is adjusted for cubic feet per second over the entire year Total during the irrigation season is 2,129 cubic feet per second

2/ Storage is in acre-feet Storage rights allow no diversion Use of stored waters requires a separate right under the specified use Storage figures are not included in the totals

3/ Represents those rights with uncoded uses in the data base

4/ Total may not agree due to rounding

No major water impoundments exist in the John Day Basin Small farm impoundments and livestock watering ponds form the majority of the storage volume According to Water Resources Department records, there are over 8,400 acre-feet of permitted storage in the basin (Draft John Day River Basin Report, 1986)

Due to natural precipitation variability, coupled with a lack of adequate upstream reservoir storage to capture spring runoff, there will always be periods when demand for water will be greater than supply

The Forest has two small municipal supply watersheds, Byram Gulch (Canyon City) and Long Creek Both watersheds have prior existing agreements between the Forest Service and the above municipalities. Long Creek has had a Water Transmission Special-Use Permit since 1937 covering 130 acres of the approximately 224 acres within the recognized watershed The watershed has been fenced to prevent bacterial contamination by domestic livestock and grazing is not allowed Timber harvest is permitted, but any road building or timber harvest activity must be designed to minimize excavation and protect streams and drainage channels The town of Long Creek currently uses water from the watershed as a domestic supply only during maintenance of their well system or during emergencies. This has resulted in use of water for this purpose on an average of only 1 day per year. Water from the watershed is used to maintain the sewage level in the town's lagoon during summer and fall, at which time water from the surface streamflow also passes through the system

The Canyon City Municipal Watershed has been used since 1926. Byram Gulch currently supplies 75 percent of Canyon City's needs, the remainder is supplied by a well located east of the city. The total drainage comprises 930 acres, of which 610 acres lie within the National Forest (310 acres within the Strawberry Mountain Wilderness), 150 acres are owned by Canyon City, 130 acres are administered by the Bureau of Land Management, and the remaining 40 acres are owned by four separate landowners. Forest Service objectives are to manage the watershed lands and resources under multiple use principles (recognizing water as the key value) and to regulate use of the area to protect and maintain water resources. Current water quality does not meet Public Health Service standards and must be chlorinated at a rate of 03 parts per million. Due to the location of the watershed, its steep terrain, and relative inaccessibility, conflicts between good watershed management and other resource uses are minimal Cattle grazing is not permitted and the area is withdrawn from mineral entry.

a *Stream Classification*

Streams on the Forest are classified into four groups Class I streams (about 320 miles) include major streams, high-value fisheries, and municipal watersheds utilizing surface waters Class II streams (about 490 miles) generally include streams with fisheries which are less significant than Class I streams Class III streams (about 1,020 miles) include some fish-bearing streams and all other perennial streams for which a higher ranking is not justified. Class IV streams (estimated at about 2,750 miles) are intermittent, but may support significant amounts of riparian vegetation

b. *Riparian Ecosystems*

Riparian areas are ecosystems characterized by vegetation requiring freely- accessible water They include the stream and an adjacent area of varying width A critical portion of the riparian zone is called a "riparian area of influence," which is the area below the non-riparian, upland vegetation The area of influence contains trees which provide shade, contribute fine or large woody material to the stream channel, terrestrial insects for the stream, and habitat for riparian wildlife Riparian areas are well-defined habitat zones located within much drier environments, they are very productive in terms of wildlife species, plant biomass and vegetation diversity While riparian areas are a minor portion of the Forest's land base, they are disproportionately important

Stream margins frequently contain highly productive timber sites. When uncontrolled, cattle use riparian zones more heavily than other areas The relatively gentle topography makes riparian zones attractive for road locations. Recreationists concentrate their use in riparian areas and scenic values are often high In addition, wildlife use riparian zones more than any other habitat type Of the 365 terrestrial species which occur in the Blue Mountains, 214 (per Table III-8) depend directly on riparian zones or utilize them more than other habitats Riparian zones along rivers and streams are frequently used as migration routes by wildlife, particularly by deer and elk traveling between summer and winter ranges.

A comprehensive inventory of riparian areas is scheduled for completion during the first ten years of the Forest Plan The inventory will be a coordinated effort between many resource areas (watershed, fisheries, range, timber and wildlife) to assure that all riparian resources and values are evaluated. The inventory will be conducted according to the publication *Managing Riparian Ecosystem (Zones) for Fish and Wildlife in Eastern Oregon and Eastern Washington*

An inventory of what has been called unsatisfactory riparian areas was prepared for this Forest planning effort It was based primarily on the Watershed Improvement Needs

(WIN) inventory and professional judgement about streams lacking adequate shade It was the first attempt to identify riparian areas needing attention in order to determine funding for correcting the problems The WIN inventory is not a "riparian area" inventory, but it does provide information about unstable streambanks and gullies It does not include the shrub, fish habitat, or shade portion of a complete, riparian-area inventory. From the WIN Inventory and professional judgment about several streams, 235 stream miles were determined to be in less than satisfactory riparian condition. This is a conservative estimate The total number of miles is expected to increase as a more complete riparian area inventory is completed in the next 10 years The Malheur National Forest has an aggressive Watershed Improvement Needs program. Each District utilized both appropriated and KV funds to complete projects Many of the inventoried problem areas existing today will be corrected through the watershed improvement needs program Watershed improvement need projects are prioritized and presented in Appendix A of the Forest Plan

Although timber harvest activities, road construction, insect outbreaks, and fire influence shading and streambank stability, the greatest affect on stream temperature and stability appears to be from a reduction in hardwoods caused by ungulate grazing With few exceptions, most of the gullies on the Forest resulted from loss of a stabilizing root system after reductions in the hardwood community

Hardwoods increase streambank stability and provide habitat for many wildlife species, including beaver Beaver dams were responsible for the maintenance and/or formation of many meadows Willow and quaking aspen meadows are substantially reduced in size and extent from historical levels. Thinleaf alder grows along water courses and provides shade and bank stability The larger size classes, those in an old and decadent condition, are being infected by a disease-causing fungus, but they are resprouting. It appears that natural succession is replacing older trees with young sprouts that will have ample light, nutrients, and moisture after competition is reduced

In historical perspective, it is likely that a great deal of woody shrubs and aspen were eliminated during a period of uncontrolled grazing around the turn of the century Several years of above average precipitation, an associated increase in other forage available to livestock, and implementation of multiple pasture grazing systems have improved much of the hardwood vegetation since the late 1960's The needs of riparian hardwoods have not been well researched, and continued monitoring of vegetative conditions in these areas is needed

Gullies are also related to loss of shrub and hardwood tree cover. Gullies cause meadow areas to drain prematurely, and may increase downstream peak flows much like artificial channelization would. Gullied meadows are less productive because of a lower water table, which reduces water available for plants Gully problems are most prevalent on the south half of the Forest

c *Relationship Between Forest Management and Water and Riparian Areas*

Timber management activities have little effect on runoff timing or amounts from the Forest The majority of past timber harvest has involved overstory removals Mature or overmature trees were selectively marked for removal, with younger age classes retained after harvest. This harvest method does not increase water yields significantly because roots of the remaining stand are still occupying the site and utilizing soil moisture The Forest does not have extensive, high-elevation snow zones where snowmelt is delayed until later in the runoff season It is believed that there is little opportunity to affect snow deposition patterns through design of harvest units and thereby delay snowmelt

Research studies indicate timber harvesting generally increases annual water yields. This is due primarily to reduced evapotranspiration Harr (1983) developed a regression equation which estimates potential increases in annual water yield from clearcutting in western Oregon and Washington Initial on-site increases of up to 20 inches are predicted, though they completely disappear in about 27 years The equation predicts a smaller water yield increase when annual precipitation is less Harr estimated that sustained increases in annual water yield from most large watersheds in western Oregon and Washington are, at best, three to six percent more than flows from an undisturbed forest. Kattelmann (1983) estimated similar maximum potential increases in Sierra Nevada watersheds if all applicable laws were followed But they concluded that the typical increase in a large watershed drops to approximately one percent when constraints are imposed to meet other resource demands A similar result is expected in Region Six National Forests due to multiple use considerations. Flow increases on Region Six National Forests have already been realized due to past harvesting, so there is little or no potential for increasing yields in most large watersheds. Other factors affecting streamflow management are high natural variability, flow measurement accuracy is only within five percent at best (so potential changes are less than what is measurable in large watersheds), and most of the flow increases occur when it is needed the least or is unusable (during spring runoff on the eastside and during fall storms on the westside).

Research generally shows increases in summer flow result immediately after harvest in western Oregon But studies in the Rocky Mountains (Troendle, 1983) showed no change in late summer streamflow following timber harvest, despite annual increases (all increases occurred during spring snowmelt). In large watersheds subject to sustained yield harvesting, summer flow increases are temporary and not expected to be measurable at downstream locations.

Effects of harvesting timber on groundwater recharge and aquifers are similar to effects on streamflow, except for timing differences, e.g , aquifer responses are typically slower and fluctuate less than streamflow The research findings mentioned above indicate that timber harvesting as it is presently practiced, and will be practiced under any selected Forest Plan alternative, is expected to have a negligible, unmeasurable effect on downstream aquifers There is no realistic potential to modify timber harvests for augmenting downstream water supplies. This assumes management practices are conducted in a manner which reasonably maintains water infiltration characteristics, as is typical of current practices on National Forest System lands Best management practices (see Forest Plan standards and guidelines) will assure adequate infiltration characteristics are maintained Only if extensive, contiguous areas were compacted would infiltration be expected to be reduced so as to adversely effect downstream aquifers

There are localized areas in some grazing allotments where improved management may restore water tables and change streamflow from intermittent to perennial. This would occur through application of "best management practices" and Forest Plan standards and guidelines. Flow increases would probably be small Resources in the immediate vicinity will benefit, but measurable increases are not expected very far downstream Downstream aquifers would not be measurably influenced

Research does not indicate that timber harvesting has a significant potential for adversely affecting aquifer quality Application of "best management practices" will ensure groundwater quality is not degraded by management activities

Increased sunlight reaching the stream surface does more to increase water temperature than other factors, such as ambient air temperature Thus, increases in water temperatures are directly related to the amount of shade removed along a stream. Changes in shading are the most important factor affecting water quality

Selection cutting (uneven-aged management) in riparian areas often removes the large trees. Shade-tolerant conifers tend to become more frequent and shade- intolerant species less common, except where ponderosa pine is the dominant species In lodgepole pine stands, regeneration harvest (clearcuts) is the most common practice.

The Malheur 1979 Timber Resource Management Plan stated that accelerated harvest will occur for 21 years to salvage dead and dying lodgepole pine in the mature and two-storied stand types. Many of these stands are located in riparian zones. Some streams are presently shade-deficient because of dead trees Fortunately, lodgepole pine is a fast-growing tree which often provides shade in 15 years or less During the intervening period, those stream reaches where salvage occurred may have elevated stream temperatures during the summer low-flow period.

Virtually any removal of large trees from a tree stand results in more light penetrating the upper canopy This usually results in more growth of understory plants, including woody and herbaceous plants and young conifers A secondary effect of promoting understory growth is increased attraction of livestock to the area

Livestock grazing has been a major factor affecting riparian areas on the Forest In recent years, livestock management has almost exclusively dealt with cattle. Due to the animals' natural preference for areas near water, use of riparian areas is disproportionately heavy unless management action is taken to disperse it. Forest-wide, abundance and diversity of riparian vegetation has been reduced In some areas the change has been fairly small, but in other stream reaches, the deciduous woody component has been largely eliminated However, many of these stream reaches have regenerating shrubs.

An increase in abundance and diversity of deciduous woody vegetation generally results from management strategies and structural improvements to minimize livestock use in riparian areas. The overall condition of riparian areas, based on vegetation abundance and diversity, generally improves as livestock use decreases Big-game use of riparian areas would tend to have the same effect as livestock use, but to a lesser degree.

Beavers have been responsible for converting streams from intermittent to perennial, with resultant increases in riparian area This process enhances the water resource by creating a reliable base flow, and wildlife by providing food and habitat Following beaver dam construction, flooding from high-intensity storms is often reduced But beavers may over use woody riparian shrubs and trees on which they depend.

Fish habitat management does not directly affect water quality or quantity except for short-term, site-specific impacts of habitat improvement projects Management of riparian areas and fisheries habitat improvement work can be compatible

The presence of water is a major recreation attraction Visitors attracted to water sources contribute to pollution and siltation Water-based recreation developments can contribute to water degradation from bacteriological sources such as sanitary facilities. Recreation activities associated with horses and pack stock are sources of fecal coliform in streams and smaller lakes Off-road vehicle use can contribute to soil disturbance on trails, stream crossings, and wetlands, which can then lead to erosion and impacts on water quality

Visual resource management does not directly affect water resources on the Forest Timber management designed to meet high visual quality standards should also protect riparian resources. Such management maintains enough canopy to provide needed shading

The two Wildernesses provide runoff for two of the major drainages on the Forest Water originating there is of high quality Wilderness runoff tends to occur somewhat later than for the rest of the Forest, which is important for contributing cooler water to the streams

Both surface and subsurface water resources can be affected by mineral exploration and development activities There may be effects on sediment yield, erosion, water chemistry, stream channel characteristics and stability, aquifer recharge, and ground water quality. These potential effects depend largely on the mineral being explored, mined, or developed, and the location of the operation. Existing laws and regulations provide protection against adverse impacts and this protection must be included in the operating plan Recreational mining activities can cause temporary and generally insignificant suspended sediment problems

The effect of roads on water resources is complicated by soil type, rainfall, road location, and side slope percent Erosion is generally the second most important factor affecting water quality (Fredricksen 1970). Whether that erosion reaches the streams is largely a factor of road location and riparian condition Healthy riparian areas act like a filter, keeping surface erosion from entering streams.

Since many Forest roads were built in riparian areas, not only do they reduce the filtering ability of the riparian zone, they also reduce the amount of riparian habitat available.

6. Recreation

The high desert country, canyons, rolling uplands, and rugged mountain peaks of the Forest provide landscape variety that is not only scenic, but offers many settings for recreational activities.

Recreationists enjoy 25 developed Forest sites for camping and picnicking, each serves from 2 to 20 families per site Visitors enjoy picnicking among the wildflowers or viewing scenery along the Forest roads. Hikers and horseback riders have more than 240 miles of trails to enjoy. Trout fishing in Forest lakes and streams is also popular. Fall brings huckleberries and hunters, a period when campgrounds receive heavy use Dispersed sites are popular for large and small hunting camps, some of which have been used by the same parties for a quarter of a century or more Snowmobiling, cross-country skiing, ice-fishing, and sledding are all popular winter activities

Strawberry Mountain Wilderness, Monument Rock Wilderness, and other unroaded areas provide settings for solitude and backcountry recreation experiences. These unroaded areas were identified during the Roadless Area Review and Evaluation conducted in the 1970's (see discussion of these areas in Appendix C).

a *Lakes*

The Forest has nine lakes or reservoirs that are considered fishable. Several small ponds exist on the Forest, but their contribution to the fishery resource is minor A listing of Forest lakes and selected physical and biological parameters is presented in Table III-14.

High, Slide, Little Slide, Strawberry, and Little Strawberry Lakes are within the Strawberry Mountain Wilderness.